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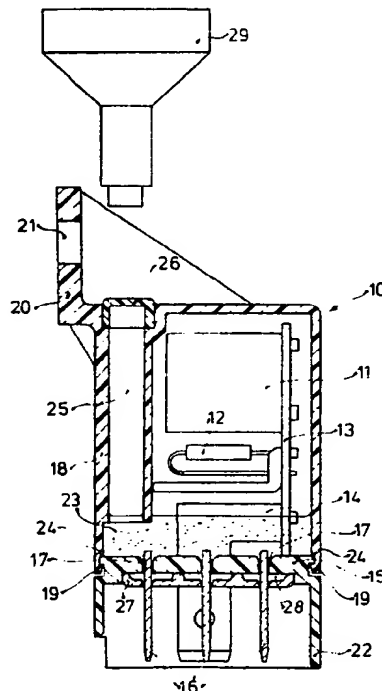
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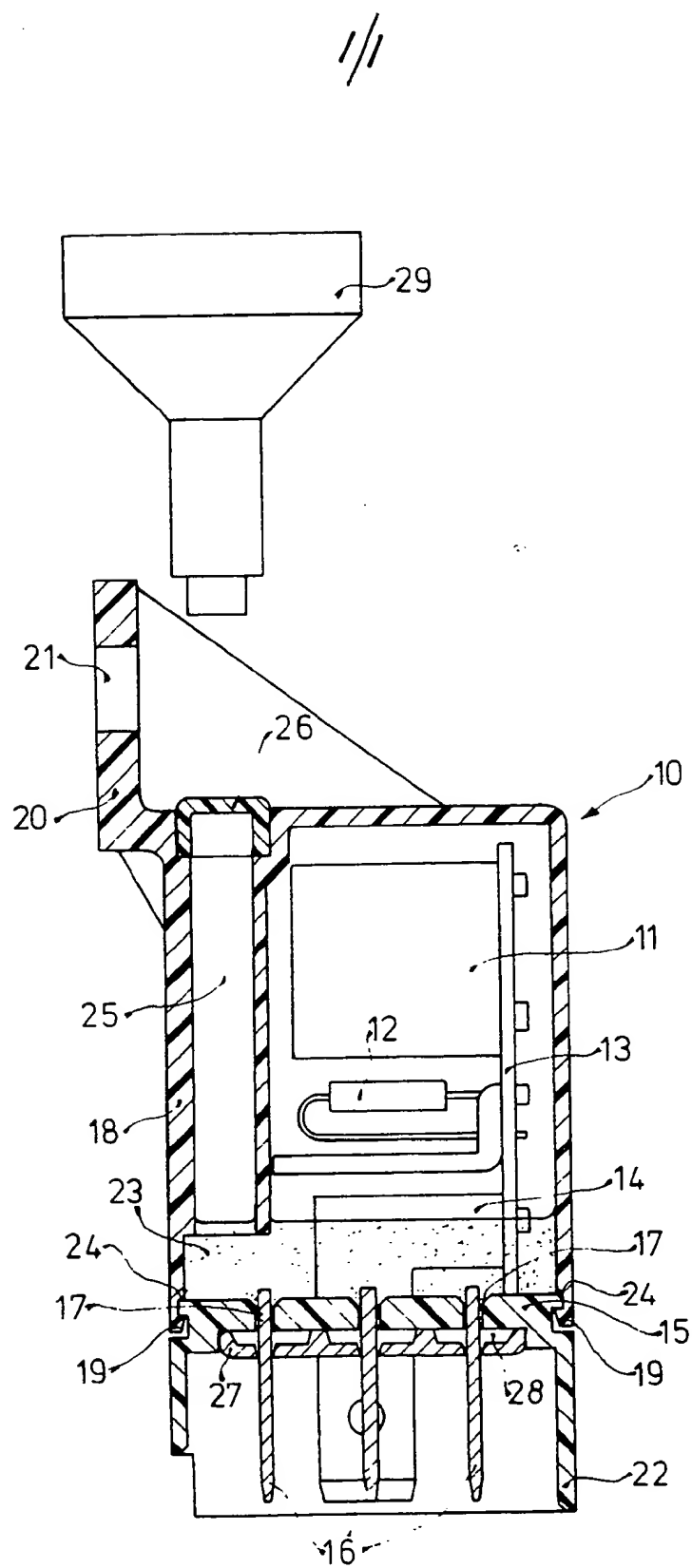
(54) An electrical device

(57) The invention provides an electrical device (10) such as a relay which is to be mounted in the engine space of a motor vehicle and has electrical parts (10, 11, 12, 13, 14) disposed on a base plate (15) of insulated material and surrounded by a protective cap (18) which is secured to the edges of the base plate and sealed by a sealing compound (23) applied to the inside of the base plate to cover the joint between the base plate (15) and the protective cap (18). The compound may also fill the gaps between the connection parts (14) and the base plate (15).

The protective cap (18) is provided with an integrally formed tube (25) for the introduction of the sealing compound, in the form of a two part resin, and which tube is

closed by a cap (26) after sealing.





## SPECIFICATION

### An electrical device

5 The invention relates to an electrical device.

In particular the invention relates to an electrical device for motor vehicles comprising a base plate of insulating material which carries electrical connections and a protective cap which surrounds the housing parts connected by the base plate and which engages over and is secured to an outer edge of the base plate.

In the known devices of this kind, no special measures are provided for sealing the electrical parts, disposed under the protective cap, against water. In these known devices, the moisture is kept away from the encapsulated electrical parts in a more or less effective manner by contact labyrinths between the protective cap and the base plate, by a continuous drip edge on the base plate or on the protective cap, and by narrow slots or bores in the base plate for the passage of connection parts. A solution of this kind is illustrated in, for example, German Patent Specification No. 15 36 823. Furthermore, it is known from German Patent Specification No. 1 014 668 to interpose a resilient seal between the protective cap and the base plate for the purpose of improved sealing of the electrical parts. Since electrical devices of this kind are being provided to an increasing extent in the engine compartments of motor vehicles where they are not protected against spray water and splash water, the known solutions are inadequate. In these cases, the sealing of encapsulated electrical devices has to be improved to an extent that moisture cannot enter the interior of the device even when the device is subjected to spray water from all sides at a spray pressure of up to 4 bar.

The object of the invention is to improve the sealing of encapsulated electrical devices by suitable, simple measures to an extent that they meet the requirements in the engine space of a motor vehicle.

According to the present invention there is provided an electrical device having a base plate of insulating material which carries electrical connections of the device, a protective cap which surrounds housing parts carried by the base plate and which engages over, and is secured to, an outer edge of the base plate and a sealing compound applied to the inside of the base plate to cover sealingly the joint or joints between the protective cap and the base plate.

Compared with the known constructions, the electrical device in accordance with the invention has the advantage that, by covering the joint between the protective cap and the base plate with a sealing compound, moisture in this region can no longer enter the interior of the electrical device.

It is particularly advantageous if the sealing compound completely covers the inside of the base plate and thereby also fills the gaps remaining between the openings in the base plate and the connection parts fitted therein. Preferably, the sealing compound is a hardenable, hard resilient two-component casting resin which covers the inside of the base plate with a layer thickness in excess of 1 mm.

The present invention will now be described further, by way of example only, with reference to the accompanying drawing which is a cross section through an electrical device with a water-proof encapsulated relay combination.

The electrical device illustrated in the drawing, and drawn to the scale 2:1, includes a relay 11 and various electronic components of which only the resistor 12 is shown. The relay 11 and the electronic components are secured to a printed circuit board 13 which is in turn secured to a base plate 15 of insulating material by punched connection members 14 which are also secured to the printed circuit board. The ends of the connection members 14 are in the form of flat plug tongues 16 which extend through corresponding openings 17 in the base plate 15. The electrical parts 11, 12, 13, 14 disposed on the base plate 15 are surrounded by a protective cap 18 which is injection-moulded from an insulating material and which engages over the outer edge of the base plate 15. The protective cap 18 is secured to the base plate 15 by a plurality of latch tongues 19 which snap onto the periphery of the base plate 15. For the purpose of mounting the electrical device 10 in the motor vehicle, a fastening bar 20 is formed on the protective cap 18 and incorporates a hole 21 for the insertion of a screw.

The outer edge of the base plate 15 is provided with a collar 22 which surrounds the outwardly projecting flat plug tongues 16 and which forms a drip edge for the spray water striking the protective cap 18 and which also constitutes a connection aid for the plugging-in of the flat plug sleeves which are accommodated in a flat plug sleeve housing (coupling).

In order to obtain optimum sealing of the electrical device 10 against spray water, a sealing compound 23 comprising a two-component casting resin is applied to, and completely covers, the inside of the base plate 15. The continuous contact surface 24 between the protective cap 18 and the edge of the base plate 15 is thereby also covered by the sealing compound 23.

In order to be able to apply the sealing compound 23 to the inside of the base plate 15 without sealing the encapsulated electrical parts, the protective cap 18 is provided with a filling tube 25 which terminates closely above the inside of the base plate 15. The sealing compound can be introduced into the filling tube 25 by means of an injection needle in an automatic manufacturing method. The sealing

compound 23 is thereby metered such that it is applied to the inside of the base plate 15 in a layer of approximately 4 mm thickness and, during hardening, adheres to the base plate 15 and to the protective cap 18. With this thick layer of sealing compound 23, the end of the filling tube 25 extends into the sealing compound 23. This opening is thus also sealed against the intrusion of moisture.

However, in order to prevent dirt and water from entering the filling tube 25, the top of the filling tube is closed by a plug 26 which is mounted onto the filling tube 25 after the sealing compound 23 has been introduced.

Since the sealing compound 23 completely covers the inside of the base plate 15, the casting resin, which has a very low viscosity when heated, also enters the gaps between the openings 17 in the base plate 15 and the flat plugs 16 inserted therein. A soft resilient cover plate 27 of polyurethane is disposed on the outside of the base plate 15 in order to prevent the sealing compound 23 from flowing outwardly through the said gaps. The cover plate 27 is pushed over the flat tongues 16 and its edge abuts outwardly against the base plate 15. That side of the cover plate 27 which faces the base plate 15 is provided with shallow recesses 28 in the region of the flat plug tongues for the purpose of receiving the sealing compound 23 which flows through the gaps at the openings 17. Since the casting resin entering the recesses 28 bonds with the material of the cover plate 27, the points at which the flat plug tongues 16 pass through the base plate 15 are also fully sealed against water. Thus, the casting resin which accumulates between the base plate 15 and the cover plate 27 in a desired manner, and which wets and glues the two parts, prevents moisture from entering between the base plate and the sealing plate and consequently prevents a reduction of the insulation resistance and of the resistance to leakage current.

The invention is not confined to the illustrated embodiment, since the sealing compound can also be applied in other ways to the base plate in the interior of the electrical device. Thus, for example, it is also possible to mount a metering funnel 29 onto the filling tube 25 of the protective cap 18 in an automatic manufacturing process. The capacity of the funnel is adapted to the required quantity of casting resin, so that, once the funnel has been filled, it has sufficient time to discharge its contents into the interior. Whilst the relay with the metering funnel 29 is passing through an oven, the casting resin becomes low-viscous and is uniformly distributed over the base plate 15. The funnel 29 is then removed and the mouth, which has remained clean, of the filling tube 25 can then be sealed by means of the plug 26.

Furthermore, in the case of automatic manu-

facture, it is also possible to coat the cover plate 27 on the outside of the base plate 15 with so-called parting agents in order to be able to remove the cover plate 27 as a reusable casting mould after the casting resin has hardened. In any case, the cover plate 27 reliably prevents the sealing compound 23 from flowing out and prevents the flat plug tongues 16 from being soiled by the sealing compound 23.

Alternatively, instead of using the soft resilient cover plate 27 which is pushed over the flat plug tongues 16, is it possible to use a covering block of appropriate configuration which is either provided with separating agents or is manufactured from a resilient material, preferably silicon rubber or fluorinated elastomers, which prevent wetting by casting resin. A reusable block of this kind or a cover plate 17 can be dispensed with if the gaps between the base plate 15 and the flat plug tongues 16 are very small, if the temperature fluctuations of the electrical device are not too great, and if the viscosity of the sealing compound is such that the compound does not flow out downwardly at these gaps.

#### CLAIMS

1. An electrical device having a base plate of insulating material which carries electrical connections of the device, a protective cap which surrounds housing parts carried by the base plate and which engages over, and is secured to, an outer edge of the base plate and a sealing compound applied to the inside of the base plate to cover sealingly the joint or joints between the protective cap and the base plate.

2. An electrical device as claimed in claim 1, in which the sealing compound completely covers the inside of the base plate.

3. An electrical device as claimed in claim 2, in which the sealing compound is a casting resin which covers the inside of the base plate in a layer having a thickness in excess of 1 mm.

4. An electrical device as claimed in any of the preceding claims, in which the electrical connections pass through openings in the base plate and the sealing compound fills the gaps between the electrical connections and the openings.

5. An electrical device as claimed in claim 4, in which a soft resilient cover plate is pushed over the connection parts from the outside and abuts against the outside of the base plate.

6. An electrical device as claimed in claim 5, in which that side of the cover plate which faces the base plate incorporates a shallow recess for receiving the sealing compound passing through the gaps.

7. An electrical device as claimed in claim 5 or 6, in which the cover plate is rigidly connected to the sealing compound emerging

at the gaps.

8. An electrical device as claimed in any preceding claim, in which the protective cap is provided with a filling tube for introducing the sealing compound, which filling tube terminates closely above the inside of the base plate.

9. An electrical device as claimed in claim 8, in which the end of the filling tube extends into the sealing compound on the inside of the base plate.

10. An electrical device as claimed in claim 8 or 9, in which the filling tube is sealed by a plug.

11. An electrical device as claimed in claim 8, 9 or 10, in which a metering funnel for a predetermined quantity of sealing compound is insertable into the filling tube.

12. An electrical device as claimed in claim 5, in which a reusable covering block in the form of a cover plate is manufactured from a resilient material which prevents wetting by casting resin.

13. An electrical device as claimed in any preceding claim, in which the electrical device is a relay for use in motor vehicles.

14. An electrical device constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

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